



RADIAN
CORPORATION

USEPA REG



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TECHNICAL NOTE

AIR QUALITY IMPACTS IN THE
PRUDHOE BAY OIL FIELD
RESULTING FROM AN EXCHANGE
OF EMISSION SOURCES

Submitted by:
SOHIO ALASKA PETROLEUM COMPANY
AND
ARCO OIL AND GAS COMPANY
ON BEHALF OF THE PRUDHOE BAY
UNIT OWNERS

Submitted to:
U. S. Environmental Protection Agency
Region X
and the
State of Alaska
Department of Environmental Conservation

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1.0 INTRODUCTION

In 1978 and 1979 SOHIO Petroleum Company and ARCO Oil and Gas Company submitted to EPA Region X, on behalf of the Prudhoe Bay Unit Owners, three PSD applications. These are entitled:

- (1) Prevention of Significant Deterioration Permit Application Submitted by Atlantic Richfield Company and SOHIO Petroleum Company on Behalf of the Prudhoe Bay Unit Owners to the U.S. Environmental Protection Agency for Construction of Additional Facilities at the Prudhoe Bay Oil Field, Prudhoe Bay, Alaska (The PSD I Application)
- (2) PSD Permit Application for the Prudhoe Bay Unit Produced Water Injection, Low Pressure Separation and Artificial Lift Projects (The PWI/LPS/AL Application)
- (3) PSD Permit Application for the Prudhoe Bay Waterflood Project (The Waterflood Application)

On October 23, 1980 representatives of the Prudhoe Bay Unit Owners met in Seattle with EPA Region X staff to discuss an emissions exchange proposal ("swap") to allow the construction of recently identified Waterflood and Produced Water Injection facilities not covered under the original applications. The purpose of this report is to provide technical support for such an exchange. To counteract the increase in emissions and air quality impacts from equipment associated with these facilities,

the Unit Owners proposed that certain pieces of equipment permitted under the PSD I application not be installed.

Representatives of EPA Region X indicated that this equipment "swap" could likely be approved if the following requirements were met.

1. Demonstrate, through annual NO_x dispersion modeling predictions that the ground level concentrations of the pollutants after the "swap" would not increase significantly (less than 1 µg/m³) from the "pre-swap" levels. The TCM model would be used.
2. Show that the net NO_x emissions increase after the "swap" would be less than or equal to zero.
3. Indicate that BACT will be applied to the proposed sources similar to BACT conditions accepted in the PWI/LPS/AL permit.

This report documents the air quality impacts of the equipment "swap" among the facilities in the Prudhoe Bay Oil Field. The total pollutant emissions resulting from this proposed action is presented and a brief discussion of the Best Available Control Technologies to be applied is provided.

2.0 SUMMARY

Two scenarios of stack parameters and operating conditions for the emissions exchange were examined (Section 3.0). The purpose of presenting two scenarios was to predict the air quality impacts based upon an upper and lower limit of unit sizes and operating conditions for the proposed sources. For each scenario the maximum predicted NO_x concentrations are less than 1.0 µg/m³ greater than the maximum NO_x concentration predicted for Case 2 of the January 14, 1980 Radian technical document. In addition, no net increase in pollutant emissions resulting from the sources presented in the PSD I, PWI/LPS/AL, and Water-flood permit applications will occur. Finally, Best Available Control Technologies (BACT) discussed in the PWI/LPS/AL permit and its supporting technical analysis will be applied to the proposed sources.

3.0 CASES EXAMINED

Two scenarios were examined in the impacts analysis and compared to a base case as outlined in the Radian technical document dated January 14, 1980, Case 2. This base case represents the "worst case" scenario submitted to EPA Region X during the permit approval process for the PWI/LPS/AL and Waterflood Applications. The purpose of using two scenarios was to provide a range to turbine and heater unit sizes and operating conditions at a given location for the proposed sources within a total horsepower or heater duty limit. Each scenario is defined by the addition of proposed sources and the deletion of selected sources identified in EPA permit No. PSD-X79-05 (PSD I).

The first scenario examined in this analysis is Case I and represents a "worst impact" case. For this scenario the sources listed in Table 3-1 would be added to the oil field facilities listed. For modeling these sources, the conservative Case I stack and operating parameter assumptions described in Table 3-2 were assumed.

The Case II scenario examined in this analysis represents a "least impact" case. The rationale used to identify Case II as "least impact" is provided in the Radian technical documents dated November 16, 1979 and January 14, 1980 which were issued as addendums to the PWI/LPS/AL and Waterflood Applications. Case II stack and operating assumptions are listed in Table 3-2.

Sources to be deleted from PSD I permit and used in the Case I and II scenarios are identified in Table 3-4. Comparisons of maximum ground level NO_x concentrations and net emissions changes among the two scenarios (Case I and II) and the base case are shown in Table 3-5. Note that a net decrease in total emissions is predicted.

TABLE 3-1
SOURCE ADDITIONS FOR
CASE I: WORST IMPACT SCENARIO

LOCATION	DESCRIPTION	UTM COORDINATES		POTENTIAL EMISSIONS			STACK CHARACTERISTICS			
		EAST (km)	NORTH (km)	NO _x (g/s)	CO (g/s)	TSP (g/s)	HEIGHT (m)	DIA (m)	VEL (m/s)	TEMP (°K)
SIPW	4-4 MHP turbines	435.0	7800.7	11.9	2.22	0.29	22.2	0.76	29.0	450
SIPW	760 MM Btu/hr of heater capacity*	435.0	7800.7	18.0	1.70	1.04	22.2	1.77	29.9	450
GC-2	1-7.5 MHP turbine	430.0	7801.8	5.6	1.04	0.14	22.2	1.16	31.4	450
GC-3	1-7.5 MHP turbine	436.7	7798.5	5.6	1.04	0.14	22.2	1.16	31.4	450
STP	3-100 MM Btu/hr heaters	443.0	7810.1	7.2	0.68	0.41	22.2	0.91	14.4	450
SIPE	4-4 MHP turbines	445.5	7795.0	11.9	2.22	0.29	22.2	0.76	29.0	450
SIPE	750 MM Btu/hr of heater capacity*	445.5	7795.0	18.0	1.70	1.04	22.2	1.77	29.9	450
SIPE	1-25 MHP turbine	445.5	7795.0	18.6	3.47	0.45	22.2	1.77	29.9	450
Total Emissions				96.8	14.07	3.80				

*This total capacity will be attained with multiple heaters with individual capacities ranging from 25 to 250 MM Btu/hr.

$$\begin{aligned} 9/5 &= 7/10 \cdot 7/4 \\ &= .09524 \times .356 \\ &= 34.7626 \end{aligned}$$

$$\begin{aligned} 5.6 \times 34.7626 \\ = 194.6 \end{aligned}$$

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TABLE 3-2
STACK PARAMETERS AND OPERATING CONDITIONS ASSUMED FOR
ADDITIONAL SOURCES MODELED FOR CASES I AND II

Location	Description	Case I	Case II
SIPW	4-4 MHP turbines	stack characteristics of 2 MHP turbine with waste heat recovery	stack characteristics of 4 MHP turbine with no waste heat recovery
SIPW	750 MM Btu/hr of heater capacity*	supplemental firing to turbines with stack characteristics of 16 MHP turbine. Waste heat recovery included.	supplemental firing to turbines with characteristics of 35 MHP turbine. Waste heat recovery included.
GC-2	1-7.5 MHP turbine	stack characteristics of 5 MHP turbine with waste heat recovery	stack characteristics of 7.5 MHP turbine with no waste heat recovery
GC-3	1-7.5 MHP turbine	stack characteristics of 5 MHP turbine with waste heat recovery	stack characteristics of 7.5 MHP turbine with no waste heat recovery
STP	3-100 MM Btu/hr heaters	stack characteristics of 25 MM Btu/hr heater with waste heat recovery	stack characteristics of 100 MM Btu/hr heater with waste heat recovery
SIPE	4-4 MHP turbines	stack characteristics of 2 MHP turbine with waste heat recovery	stack characteristics of 4 MHP turbine with no waste heat recovery
SIPE	750 MM Btu/hr of heater capacity*	supplemental firing to turbine with stack characteristics of 16 MHP turbines. Waste heat recovery included.	supplemental firing to turbines with stack characteristics of 36 MHP turbine. Waste heat recovery included.
SIPE	1-25 MHP turbine	stack characteristics of 16 MHP turbine with waste heat recovery	stack characteristics of 36 MHP turbine with waste heat recovery

*This total capacity will be attained with multiple heaters with individual capacities ranging from 25 to 250 MM Btu/hr.

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TABLE 3-3
 SOURCE ADDITIONS FOR
 CASE II: LEAST IMPACT SCENARIO

LOCATION	DESCRIPTION	UTM COORDINATES		POTENTIAL EMISSIONS			STACK CHARACTERISTICS			
		EAST (km)	NORTH (km)	NO _x (g/s)	CO (g/s)	TSP (g/s)	HEIGHT (m)	DIA (m)	VEL (m/s)	TEMP (°K)
SIPW	4-4 MHP turbines	435.0	7800.7	11.9	2.22	0.29	22.2	1.22	39.3	780
SIPW	750 MM Btu/hr of heater capacity*	435.0	7800.7	18.0	1.70	1.04	22.2	2.44	35.4	450
GC-2	1-7.5 MHP turbine	430.0	7801.8	5.6	1.04	0.14	22.2	1.83	32.6	780
GC-3	1-7.5 MHP turbine	436.7	7798.5	5.6	1.04	0.14	22.2	1.83	32.6	780
STP	3-100 MM Btu/hr heaters	443.0	7810.1	7.2	0.68	0.41	22.2	1.83	14.4	450
SIPE	4-4 MHP turbines	445.5	7795.0	11.9	2.22	0.29	22.2	1.22	39.3	780
SIPE	750 MM Btu/hr of heater capacity*	445.5	7795.0	18.0	1.70	1.04	22.2	2.44	35.4	450
SIPE	1-25 MHP turbine	445.5	7795.0	18.6	3.47	0.45	22.2	2.44	35.4	450
Total Emissions				96.8	16.07	3.80				

*This total capacity will be attained with multiple heaters with individual capacities ranging from 25 to 250 MM Btu/hr.

TABLE 3-4
SOURCES IN 1978 APPLICATION TO BE DELETED

LOCATION	DESCRIPTION	UTM COORDINATES		POTENTIAL EMISSIONS			STACK CHARACTERISTICS			
		EAST (km)	NORTH (km)	NO _x (g/s)	CO (g/s)	TSP (g/s)	HEIGHT (m)	DIA (m)	VEL (m/s)	TEMP (°K)
CCP	3-25 MHP turbines	443.7	7802.2	41.2	11.42	1.40	26.8	2.43	50.6	755
FS-2	2-25 MHP turbines	449.5	7795.5	27.1	7.53	0.92	26.8	2.43	50.6	755
CPS	2-25 MW turbine generators	437.5	7797.2	36.9	10.28	1.26	16.7	2.80	42.0	755
GC-3	1-17 MHP turbine	436.7	7798.5	<u>8.8</u>	<u>2.45</u>	<u>0.30</u>	16.7	2.69	35.0	755
Total Emissions				114.0	31.68	3.88				

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TABLE 3-5
 MAXIMUM PREDICTED ANNUAL NO_x CONCENTRATIONS AND
 NET CHANGES IN POTENTIAL EMISSIONS FOR THE
 BASE CASE, THE WORST IMPACT SCENARIO
 AND THE LEAST IMPACT SCENARIO

Scenario	Maximum Annual NO _x Concentration (μg/m ³)	Net Changes in Potential Emissions (g/s)*		
		NO _x	CO	TSP
Base Case	71.03	-	-	-
Worst Impact (Case I)	71.70	-17.2	-17.6	-.08
Least Impact (Case II)	71.40	-17.2	-15.6	-.08

*Net emissions changes are compared to the Base Case (no change in emissions).

4.0 ANALYTICAL METHODS

The modeling methods discussed in the PWI/LPS/AL and Waterflood Applications were those used to predict the annual NO₂ concentrations reported here. The Texas Climatological Model (TCM) was used for annual concentration predictions and concentrations were calculated for rectangular receptor grids with 0.25 km grid spacings. Meteorological inputs to this model consisted of a joint frequency distribution of stability, wind speed, and wind direction developed from surface meteorological observations taken at Barter Island, Alaska, for the period 1958-1964. In this modeling exercise all NO_x was assumed to be emitted as or converted to NO₂. In addition, it was assumed for each facility (gathering centers, flow stations, Central Compressor Plant, etc.) that all proposed sources were colocated. To provide a comparison to the base case, 70 percent of Briggs' plume rise was assumed.

For the modeling analysis a background NO₂ concentration of 1 µg/m³ was assumed. For the purposes of this study, the term "background" refers to the contributions to total air quality from all anthropogenic and natural sources outside of or upwind from the Prudhoe Bay area. A discussion of the method used to estimate this background level is presented in the PWI/LSP/AL and Waterflood Applications.

The emissions inventories input to the TCM for the cases examined are listed in Tables 4-1 and 4-2. The source changes discussed in Section 3.0 are reflected in these tables.

TABLE 4-1

 *
 : CASE 1 EMISSIONS AS MODELED (NOX) *
 *

UTM COORD. (KM)		NOX EMISS.	HS	DS	VS	TS	SOURCE ID	
E	N	(G/S)	(M)	(M)	(M/S)	(°C)		
449.507794.60		0.434	0.0000	15.20	1.00	10.600	350.00	ARCO P-357
449.507794.60		0.03	0.0000	15.20	0.30	10.600	350.00	ARCO P-357
440.407794.70		2.7	0.0000	15.20	1.00	10.600	350.00	ARCO P-358
449.307794.40		1.33	0.0000	15.20	1.20	10.600	282.00	ARCO P-136
449.307794.40		0.396	0.0000	10.70	0.90	6.900	760.00	ARCO P-136
446.007795.20		14.8	0.0000	13.10	2.50	20.100	371.00	ARCO P-138
446.007795.20		2.98	0.0000	15.20	0.30	10.600	350.00	ARCO P-138
449.507795.50		14.8	0.0000	13.10	2.50	20.100	371.00	ARCO P-381
449.507795.50		2.98	0.0000	15.20	0.30	10.600	350.00	ARCO P-381
440.707795.70		14.8	0.0000	13.10	2.50	20.100	371.00	ARCO P-443
440.707795.70		2.98	0.0000	15.20	0.30	10.600	350.00	ARCO P-443
443.707802.20		0.578	0.0000	16.10	0.90	10.600	338.00	ARCO P-326
443.707802.20		164.	0.0000	26.80	2.40	50.600	482.00	ARCO P-324
443.707802.20		1.53	0.0000	9.10	1.10	10.600	246.00	ARCO P-324
435.807799.50		0.037	0.0000	7.30	0.50	6.900	815.00	SOHIO P-338
435.807799.50		0.13	0.0000	7.30	0.50	7.400	815.00	SOHIO P-338
437.507797.20		109.2	0.0000	15.80	2.70	50.600	504.00	SOHIO P-185
437.507797.20		20.31	0.0000	15.80	2.70	50.600	504.00	SOHIO P-185
447.907792.00		1.25	0.0000	3.70	0.20	15.200	448.00	DOW. P-325
447.907792.00		0.078	0.0000	3.70	0.20	7.400	448.00	DOW. P-325
447.3 7791.0		0.76	0.0000	20.00	0.90	13.700	177.00	NANA P-413
447.3 7791.0		0.38	0.0000	20.00	0.90	7.40	177.00	NANA P-413
439.007776.00		25.1	0.0000	13.70	3.30	22.800	454.00	ALY. P-289
439.007796.00		1.04	0.0000	13.70	3.30	22.800	454.00	ALY. P-289
439.007750.00		1.56	0.0000	13.70	1.00	10.700	350.00	ALY. P-289
439.007796.00		0.0	0.0000	7.90	0.40	6.900	871.00	ALY. P-289
439.007796.00		0.062	0.0000	7.90	0.40	7.400	871.00	ALY. P-289
444.407789.40		9.66	0.0000	7.60	0.50	18.300	148.00	NANA P-423
444.4 7789.4		.04		10.7	0.9	6.9	760.	NANA P-424
446.007791.60		7.00	0.0000	7.60	0.50	15.200	148.00	VE P-482
446.007791.60		0.195	0.0000	10.60	0.90	6.900	760.00	VE P-482
444.807794.60		0.26	0.0000	12.20	1.10	6.900	698.00	ARCO P-355

TABLE 4-1 (Continued)

Ull Coord. (km)	No.	Emiss. (g/s)	HS(m)	DS(m)	VS(m/s)	TS(°C)	Source ID
449.807794.60	0,08	0.0000	12.20	0.80	7.400	1093.00	ARCO P-356
435.807799.50	0,063	0.0000	12.20	0.50	6.900	1093.00	SOHIO P-191
435.807799.50	0,003	0.0000	12.20	0.50	7.400	815.00	SOHIO P-191
435.807799.50	.2	0.0000	6.70	0.50	18.300	387.00	SOHIO P-266
430.007803.50	0,03	0.0000	12.20	0.50	6.900	815.00	SOHIO P-374
430.007803.50	0,106	0.0000	12.20	0.50	7.400	815.00	SOHIO P 374
445.007789.00	15.67	0.0000	10.70	0.60	22.800	155.00	DH. ARPRT
445.707791.20	7.83	0.0000	10.70	0.50	18.300	155.00	FRONTIER
427.007801.80	2.61	0.0000	10.70	0.30	18.300	155.00	AGC
446.507791.20	13.06	0.0000	10.70	0.60	15.200	155.00	DNA
434.707801.00	2,83	0.0000	10.00	0.61	14.200	233.00	SOHIO GC1
434.707801.00	0,38	0.0000	18.00	0.41	8.600	233.00	SOHIO GC1
430.007801.80	2,83	0.0000	10.00	0.61	14.200	233.00	SOHIO GC2
430.007801.80	0,38	0.0000	18.00	0.41	8.600	233.00	SOHIO GC2
436.707798.50	2,83	0.0000	10.00	0.61	14.200	233.00	SOHIO GC3
436.707798.50	0,38	0.0000	18.00	0.41	8.600	233.00	SOHIO GC3
437.507797.20	0,28	0.0000	18.00	0.38	3.500	233.00	SOHIO CPS
430.007801.80	35,33	0.0000	16.70	1.71	50.0	197.00	SOHIO GC2
436.707798.50	8.8	0.0000	16.70	2.69	35.000	482.00	SOHIO GC3
437.507797.20	36,9	0.0000	16.70	2.80	42.00	482.00	SOHIO CPS
434.707801.00	5,20	0.0000	16.7	0.88	50.000	557.00	GC-1
434.707801.00	1,04	0.0000	16.7	0.55	50.000	557.00	GC-1
434.707801.0	67.20	0,00	16.7	1.71	50.0	197.	GC-1
434.707801.00	2,04	0.0000	7,6	.94	10.600	350.00	GC-1
434.707801.00	0,12	0.0000	18,3	0.43	10.600	350.00	GC-1
434.707801.00	7,39	0.0000	7,6	.73	10.600	350.00	GC-1
430.007801.80	5,20	0.0000	16,7	0.88	50.000	557.00	GC-2
430.007801.80	1,04	0.0000	16,7	0.55	50.000	557.00	GC-2
430.007801.80	161.85	0.0000	16,7	1.71	50.0	197.	GC-2 ALL
430.007801.80	3,05	0.0000	7,6	.94	10.600	350.00	GC-2
430.007801.80	7,39	0.0000	7,6	.73	10.600	350.00	GC-2
430.007801.80	0,12	0.0000	18,3	0.43	10.600	350.00	GC-2
436.707798.50	5,20	0.0000	16,7	0.88	50.000	557.00	GC-3
436.707798.50	1,04	0.0000	16,7	0.55	50.000	557.00	GC-3
436.707798.50	84.86	0.0000	16,7	1.71	50.0	197.	GC-3 ALL
436.707798.50	2,01	0.0000	7,6	.94	10.600	350.00	GC-3
436.707798.50	0,12	0.0000	18,3	0.43	10.600	350.00	GC-3
436.707798.50	7,39	0.0000	7,6	.73	10.600	350.00	GC-3

Table 4-1 (Continued)

UTM Coord. (km)	NO _x Emiss. (g/s)	HS (m)	DS (m)	VS (m/s)	TS (°C)	SOURCE ID	
437.107804,70	0.24	0.0000	14.00	0.60	14.300	233.00	DRILL PAD E
433.507804,40	0.24	0.0000	14.00	0.60	14.300	233.00	DRILL PAD F
435.007802,30	0.24	0.0000	14.00	0.60	14.300	233.00	DRILL PAD G
434.907799,60	0.24	0.0000	14.00	0.60	14.300	233.00	DRILL PAD D
430.907800,10	0.24	0.0000	14.00	0.60	14.300	233.00	DRILL PAD H
430.907803,20	0.24	0.0000	14.00	0.60	14.300	233.00	DRILL PAD J
426.407804,20	0.24	0.0000	14.00	0.60	14.300	233.00	DRILL PAD M
420.107802,50	0.24	0.0000	14.00	0.60	14.300	233.00	DRILL PAD N
420.507804,20	0.24	0.0000	14.00	0.60	14.300	233.00	DRILL PAD R
431.007801,60	0.24	0.0000	14.00	0.60	14.300	233.00	DRILL PAD Q
423.507804,20	0.24	0.0000	14.00	0.60	14.300	233.00	DRILL PAD S
431.207796,80	0.24	0.0000	14.00	0.60	14.300	233.00	DRILL PAD Y
434.007796,60	0.24	0.0000	14.00	0.60	14.300	233.00	DRILL PAD A
437.307799,70	0.24	0.0000	14.00	0.60	14.300	233.00	DRILL PAD C
437.007793,30	0.24	0.0000	14.00	0.60	14.300	233.00	DRILL PAD X
437.007796,60	0.24	0.0000	14.00	0.60	14.300	233.00	DRILL PAD B
443.707802,20	18.58	0.0000	16.7	1.71	50.0	197.	CCP ALL
443.707802,20	0.63	0.0000	9.10	0.50	14.100	246.00	CCP
446.007795,20	7.44	0.0000	16.80	1.00	29.700	475.00	FS-1
446.007795,20	00.29	0.0000	16.7	1.71	50.0	197.	FS-1 ALL
449.507795,50	107.05	0.0000	16.7	1.71	50.0	197.	FS-2 ALL
449.507795,50	7.44	0.0000	16.80	1.00	29.700	475.00	FS-2
449.507795,50	2.39	0.0000	15.0	0.9	12.0	257.	FS-2
440.707795,70	107.05	0.0000	16.7	1.71	50.0	197.	FS-3 ALL
440.7 7795,7	7.44	0.0	16.8	1.0	29.7	475.0	FS-3
443.007810,13	2.85	0.0000	28.00	1.00	12.000	257.00	SWTR. TRT.
443.007810,13	7.88	0.0000	28.00	1.40	12.000	257.00	SWTR. TRT.
445.507795,00	59.47	0.0000	21.00	2.40	16.200	177.00	E INJ PLT
435.007800,70	59.47	0.0000	21.00	2.40	16.200	177.00	W INJ PLT
445.507795,00	2.39	0.0000	15.00	0.90	12.000	257.00	E INJ PLT
435.007800,70	2.39	0.0000	18.3	0.90	12.000	257.00	W INJ PLT
435.0 7800,7	11.9		22.2	0.76	29.0	176.85	SIPW TURBINE
435.0 7800,7	18.0		22.2	1.77	29.9	176.85	SIPW HEATRS
430.0 7801,8	5.6		22.2	1.16	31.4	176.85	GC2 TURB
436.7 7798,5	5.6		22.2	1.16	31.4	176.85	GC3 TURB
443.0 7810,13	7.2		22.2	0.91	14.4	176.85	STP HTRS
445.5 7795,0	11.9		22.2	0.76	29.0	176.85	SIPE TURBNS
445.5 7795,0	18.0		22.2	1.77	29.9	176.85	SIPE HEATRS
445.5 7795,0	18.6		22.2	1.77	29.9	176.85	SIPE TURBNS

TABLE 4-2

 *
 * CASE 2 EMISSIONS AS MODELED (NOX) *
 *

UTM COORD. (KM)		NOX EMISS.	HIS	DS	VS	TS	SOURCE ID	
E	N	(G/S)	(M)	(M)	(M/S)	(°C)		
449.507794.60		0.434	0.0000	15.20	1.00	10.600	350.00	ARCO P-357
449.507794.60		0.03	0.0000	15.20	0.30	10.600	350.00	ARCO P-357
440.407794.70		2.7	0.0000	15.20	1.00	10.600	350.00	ARCO P-35A
449.307794.40		1.33	0.0000	15.20	1.20	10.600	282.00	ARCO P-136
449.307794.40		0.396	0.0000	10.70	0.90	6.900	760.00	ARCO P-136
446.007795.20		14.8	0.0000	13.10	2.50	20.100	371.00	ARCO P-13A
446.007795.20		2.98	0.0000	15.20	0.30	10.600	350.00	ARCO P-13A
449.507795.50		14.8	0.0000	13.10	2.50	20.100	371.00	ARCO P-381
449.507795.50		2.98	0.0000	15.20	0.30	10.600	350.00	ARCO P-301
440.707795.70		14.8	0.0000	13.10	2.50	20.100	371.00	ARCO P-443
440.707795.70		2.98	0.0000	15.20	0.30	10.600	350.00	ARCO P-443
443.707802.20		0.578	0.0000	16.10	0.90	10.600	338.00	ARCO P-326
443.707802.20		164.	0.0000	26.80	2.40	50.600	482.00	ARCO P-324
443.707802.20		1.53	0.0000	9.10	1.10	10.600	246.00	ARCO P-324
435.807799.50		0.037	0.0000	7.30	0.50	6.900	815.00	SOHIO P-338
435.807799.50		0.13	0.0000	7.30	0.50	7.400	815.00	SOHIO P-338
437.507797.20		109.2	0.0000	15.80	2.70	50.600	504.00	SOHIO P-185
437.507797.20		20.31	0.0000	15.80	2.70	50.600	504.00	SOHIO P-185
447.907792.00		1.25	0.0000	3.70	0.20	15.200	448.00	DOW. P-325
447.907792.00		0.078	0.0000	3.70	0.20	7.400	448.00	DOW. P-325
447.3 7791.0		0.76	0.0000	20.00	0.90	13.700	177.00	NANA P-413
447.3 7791.0		0.38	0.0000	20.00	0.90	7.40	177.00	NANA P-413
439.007796.00		25.1	0.0000	13.70	3.30	22.800	454.00	ALY. P-289
439.007796.00		1.04	0.0000	13.70	3.30	22.800	454.00	ALY. P-289
439.007796.00		1.56	0.0000	13.70	1.00	10.700	350.00	ALY. P-289
439.007796.00		0.0	0.0000	7.90	0.40	6.900	871.00	ALY. P-289
439.007796.00		0.062	0.0000	7.90	0.40	7.400	871.00	ALY. P-289
444.407789.40		9.66	0.0000	7.60	0.50	18.300	148.00	NANA P-423
444.4 7789.4		.04		10.7	0.9	6.9	760.	NANA P-424
446.007791.60		7.00	0.0000	7.60	0.50	15.200	148.00	VE P-482
446.007791.60		0.195	0.0000	10.60	0.90	6.900	760.00	VE P-482
449.807794.60		0.26	0.0000	12.20	1.10	6.900	698.00	ARCO P-355

RADIANT CORPORATION

TABLE 4-2 (Continued)

Off Coord. (km)	NO _x Emiss. (g/s)	HS(m)	DS(m)	VS(m/s)	TS(°C)	SOURCE ID	
449.807794.60	0.08	0.0000	12.20	0.80	7.400	1093.00	ARCO P-356
435.807799.50	0.063	0.0000	12.20	0.50	6.900	1093.00	SOHIO P-191
435.807799.50	0.003	0.0000	12.20	0.50	7.400	815.00	SOHIO P-191
435.807799.50	.2	0.0000	6.70	0.50	18.300	387.00	SOHIO P-266
430.007803.50	0.03	0.0000	12.20	0.50	6.900	815.00	SOHIO P-374
430.007803.50	0.106	0.0000	12.20	0.50	7.400	815.00	SOHIO P-374
445.007789.00	15.67	0.0000	10.70	0.60	22.800	155.00	DH. ARPRT
445.707791.20	7.85	0.0000	10.70	0.50	18.300	155.00	FRONTIER
427.007811.80	2.61	0.0000	10.70	0.30	18.300	155.00	AGC
446.507791.20	13.06	0.0000	10.70	0.60	15.200	155.00	DDA
434.707811.00	2.85	0.0000	10.00	0.61	14.200	233.00	SOHIO GC1
434.707801.00	0.38	0.0000	18.00	0.41	8.600	233.00	SOHIO GC1
430.007801.80	2.85	0.0000	10.00	0.61	14.200	233.00	SOHIO GC2
430.007801.80	0.38	0.0000	18.00	0.41	8.600	233.00	SOHIO GC2
436.707798.50	2.85	0.0000	10.00	0.61	14.200	233.00	SOHIO GC3
436.707798.50	0.38	0.0000	18.00	0.41	8.600	233.00	SOHIO GC3
437.507797.20	0.28	0.0000	18.00	0.38	3.500	233.00	SOHIO GC3
430.007801.80	35.33	0.0000	16.70	1.71	50.0	197.00	SOHIO CPS
436.707798.50	0.8	0.0000	16.70	2.69	35.000	482.00	SOHIO GC2
437.507797.20	36.9	0.0000	16.70	2.80	42.00	482.00	SOHIO GC3
434.707801.00	5.20	0.0000	16.7	0.98	50.000	557.00	SOHIO CPS
434.707801.00	1.04	0.0000	16.7	0.55	50.000	557.00	GC-1
434.707801.0	67.20	0.00	16.7	1.71	50.0	197.	GC-1
434.707801.00	2.04	0.0000	7.6	.94	10.600	350.00	GC-1
434.707801.00	0.12	0.0000	18.3	0.43	10.600	350.00	GC-1
434.707801.00	7.39	0.0000	7.6	.73	10.600	350.00	GC-1
430.007801.80	5.20	0.0000	16.7	0.88	50.000	557.00	GC-1
430.007801.80	1.04	0.0000	16.7	0.55	50.000	557.00	GC-2
430.007801.80	161.85	0.0000	16.7	1.71	50.0	197.	GC-2
430.007801.80	3.05	0.0000	7.6	.94	10.600	350.00	GC-2 ALL
430.007801.80	7.39	0.0000	7.6	.73	10.600	350.00	GC-2
430.007801.80	0.12	0.0000	18.3	0.43	10.600	350.00	GC-2
436.707798.50	5.20	0.0000	16.7	0.88	50.000	557.00	GC-2
436.707798.50	1.04	0.0000	16.7	0.55	50.000	557.00	GC-3
436.707798.50	84.86	0.0000	16.7	1.71	50.0	197.	GC-3
436.707798.50	2.01	0.0000	7.6	.94	10.600	350.00	GC-3 ALL
436.707798.50	0.12	0.0000	18.3	0.43	10.600	350.00	GC-3
436.707798.50	7.39	0.0000	7.6	.73	10.600	350.00	GC-3

TABLE 4-2 (Continued)

HEI Coord. (km)	DC _x EmIss. (g/s)	HS (m)	DS (m)	VS (m/s)	TS (°C)	SOURCE ID	
437.107804.70	0.24	0.0000	14.00	0.60	14.300	233.00	DRILL PAD E
433.507804.40	0.24	0.0000	14.00	0.60	14.300	233.00	DRILL PAD F
435.007802.30	0.24	0.0000	14.00	0.60	14.300	233.00	DRILL PAD G
434.907799.60	0.24	0.0000	14.00	0.60	14.300	233.00	DRILL PAD D
430.907800.10	0.24	0.0000	14.00	0.60	14.300	233.00	DRILL PAD H
430.907903.20	0.24	0.0000	14.00	0.60	14.300	233.00	DRILL PAD J
426.407904.20	0.24	0.0000	14.00	0.60	14.300	233.00	DRILL PAD M
428.107802.30	0.24	0.0000	14.00	0.60	14.300	233.00	DRILL PAD N
428.507904.20	0.24	0.0000	14.00	0.60	14.300	233.00	DRILL PAD R
431.007801.60	0.24	0.0000	14.00	0.60	14.300	233.00	DRILL PAD Q
423.507904.20	0.24	0.0000	14.00	0.60	14.300	233.00	DRILL PAD S
431.207796.80	0.24	0.0000	14.00	0.60	14.300	233.00	DRILL PAD Y
434.007796.60	0.24	0.0000	14.00	0.60	14.300	233.00	DRILL PAD A
437.307799.70	0.24	0.0000	14.00	0.60	14.300	233.00	DRILL PAD C
437.007793.30	0.24	0.0000	14.00	0.60	14.300	233.00	DRILL PAD X
437.007796.60	0.24	0.0000	14.00	0.60	14.300	233.00	DRILL PAD B
443.707802.20	10.58	0.0000	16.7	1.71	50.0	197.	CCP ALL
443.707802.20	0.63	0.0000	9.10	0.50	14.100	246.00	CCP
446.007795.20	7.44	0.0000	16.80	1.00	29.700	475.00	FS-1
446.007795.20	80.29	0.0000	16.7	1.71	50.0	197.	FS-1 ALL
449.507795.50	107.05	0.0000	16.7	1.71	50.0	197.	FS-2 ALL
449.507795.50	7.44	0.0000	16.80	1.00	29.700	475.00	FS-2
449.507795.50	2.39	0.0000	15.0	0.9	12.0	257.	FS-2
440.707795.70	107.05	0.0000	16.7	1.71	50.0	197.	FS-3 ALL
440.7 7795.7	7.44	0.0	16.8	1.0	29.7	475.0	FS-3
443.007810.13	2.85	0.0000	28.00	1.00	12.000	257.00	SWTR. TRT.
443.007810.13	7.88	0.0000	28.00	1.40	12.000	257.00	SWTR. TRT.
445.507795.00	59.47	0.0000	21.00	2.40	16.200	177.00	E INJ PLT
435.007800.70	59.47	0.0000	21.00	2.40	16.200	177.00	W INJ PLT
445.507795.00	2.39	0.0000	15.00	0.90	12.000	257.00	E INJ PLT
435.007800.70	2.39	0.0000	18.3	0.30	12.000	257.00	W INJ PLT
435.0 7800.7	11.9		22.2	1.22	39.3	506.85	SIPW TURBINE
435.0 7800.7	18.0		22.2	2.44	35.4	176.85	SIPW HEATRS
430.0 7801.0	5.6		22.2	1.83	32.6	506.85	GC2 TURB
436.7 7798.5	5.6		22.2	1.83	32.6	506.85	GC3 TURB
443.0 7810.13	7.2		22.2	1.83	14.4	176.85	STP HTRS
445.5 7795.0	11.9		22.2	1.22	39.3	506.85	SIPE TURBNS
445.5 7795.0	18.0		22.2	2.44	35.4	176.85	SIPE HEATRS
445.5 7795.0	18.6		22.2	2.44	35.4	176.85	SIPE TURBNS

5.0 AIR QUALITY IMPACTS

The atmospheric dispersion modeling results show that for each scenario examined, the maximum predicted concentrations are less than $1 \mu\text{g}/\text{m}^3$ higher than the maximum concentration predicted for Case 2 of the January 14, 1980 Radian technical document. For Case I, the maximum predicted concentration (including the $1 \mu\text{g}/\text{m}^3$ background) is $71.70 \mu\text{g}/\text{m}^3$ and for Case II the maximum level of $71.03 \mu\text{g}/\text{m}^3$ predicted for Case 2 of the January 14, 1980 document. All three maxima are predicted to occur at the same receptor (UTM coordinate: 7791.12 kilometers Northing, 445.12 kilometers Easting).

6.0 BEST AVAILABLE CONTROL TECHNOLOGY (BACT) DISCUSSION

BACT as described in the PWI/LPS/AL PSD permit (Permit No. PSD-X80-09) will be applied to the gas fired turbines and heaters proposed in this report. These BACT conditions are summarized below.

Turbines

1. Natural gas firing and the use of dry (internal combustion) controls.

Heaters

1. Natural gas firing.
2. For process heaters with a rated capacity greater than 43 MM Btu/hr low NO_x burners will be installed.
3. For process heaters with a rated capacity greater than 43 MM Btu/hr. The levels of CO or O₂ in the combustion flue gas will be monitored on a continuous or periodic basis as an indicator of good combustion.

ERRATA

1. The 25 MHP turbine at SIPE listed in Tables 3-1, 3-2, and 3-3 is actually an incremental 25 MHP of turbine capacity in addition to that listed in the Waterflood PSD application. Unit sizes may vary from 16 to 36 MHP.

2. The following typographical errors exist:
 - a. Table 3-1
"760 MMBTU/hr." of heater capacity at SIPW should be 750 MMBTU/hr.
 - b. Table 3-2
For assumption No. 2 under Case II the "35 MHP" turbine should be 36 MHP
 - c. Table 3-3
The total CO emissions of "16.07 g/s" should read 14.07 g/s.
 - d. Table 3-5
The net change in CO emissions for Case II of "-15.6 g/s" should be -17.6 g/s.

3. For clarity, the following source acronyms are identified:

SIPW: Seawater Injection Plant - West Side

GC-2: Gathering Center No. 2

GC-3: Gathering Center No. 3

STP : Seawater Treatment Plant

SIPE: Seawater Injection Plant - East Side